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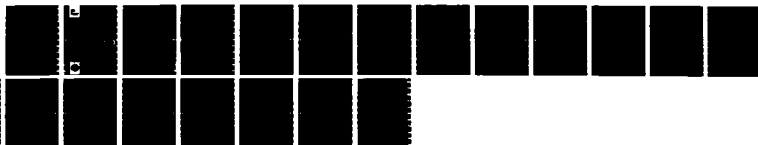
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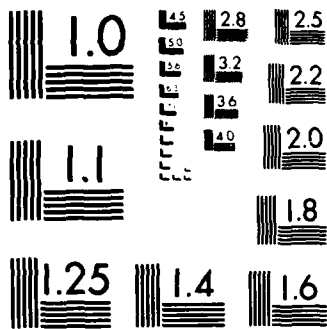
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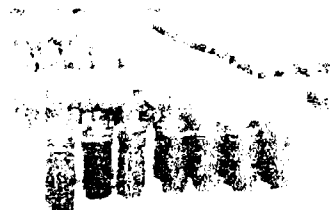
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ENVIRONMENTAL IMPACT RESEARCH PROGRAM

TECHNICAL REPORT EL 76-31

SMOOTH BROME (*Bromus inermis*)

Section 7.1.1, US ARMY CORPS OF ENGINEERS
WILDLIFE RESOURCES MANAGEMENT MANUAL

by

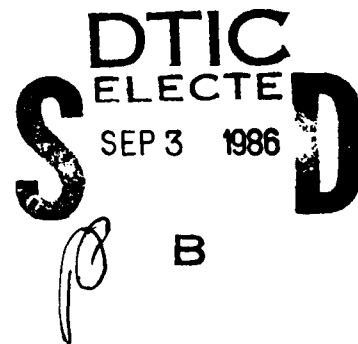
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July 1986
Final Report

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DEPARTMENT OF THE ARMY
Corps of Engineers
Waterways Experiment Station

Fort Belvoir, Illinois 62206

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<p>A plant materials report on smooth brome (<i>Bromus inermis</i>) is provided as Section 7.1.1 of the US Army Corps of Engineers Wildlife Resources Management Manual. The report was prepared as a guide to assist the Corps District or project biologist with the selection, cultivation, and management of suitable plant materials for wildlife and habitat development programs. Topics covered include description, distribution, habitat requirements, wildlife values, establishment, maintenance, and cautions and limitations.</p> <p>Smooth brome is a widely adapted, long-lived perennial grass that has become naturalized throughout much of the central and northern United States. It is a preferred species for pasture and rangeland seedings and is useful for wildlife cover and soil conservation. The distribution and distinguishing characteristics are described, and soil, moisture, and shade requirements are specified. Food and cover value for wildlife is discussed, and species</p> <p style="text-align: right;">(Continued)</p>					
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known to use *Bromus* as food are listed. The section on establishment provides guidelines for site selection, site preparation, propagule selection, and planting methods. Selected northern and southern strains of smooth brome are listed, and their general characteristics are given. Maintenance requirements are discussed, and tolerances to grazing, mowing, fertilization, and herbicides are noted.



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PREFACE

This work was sponsored by the Office, Chief of Engineers (OCE), US Army, as part of the Environmental Impact Research Program (EIRP), Work Unit 31631, entitled Management of Corps Lands for Wildlife Resource Improvement. The Technical Monitors for the study were Dr. John Bushman and Mr. Earl Eiker, OCE, and Mr. Dave Mathis, Water Resources Support Center.

This report was prepared by Mr. Clinton H. Wasser, Professor Emeritus, Range Science Department, Colorado State University, Fort Collins, Colo., and Dr. Phillip L. Dittberner, US Fish and Wildlife Service, Western Energy and Land Use Team (WELUT), Fort Collins, Colo., under an Interagency Agreement with the US Army Engineer Waterways Experiment Station (WES). Mr. Chester O. Martin, Wetlands and Terrestrial Habitat Group (WTHG), Environmental Laboratory (EL), WES, was principal investigator for the work unit. Ms. Cathy Short and Ms. Pam Hutton, WELUT, assisted with manuscript preparation. Review and comments were provided by Mr. Martin and Dr. Wilma A. Mitchell, WTHG, and Mr. Larry E. Marcy, Texas A&M University.

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COL Allen F. Grum, USA, was the previous Director of WES. COL Dwayne G. Lee, CE, is the present Commander and Director. Dr. Robert W. Whalin is Technical Director.

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NOTE TO READER

This report designated as Section 7.1.1 in Chapter 7 -- PLANT MATERIALS, Part 7.1 -- GRASSES, of the US ARMY CORPS OF ENGINEERS WILDLIFE RESOURCES MANAGEMENT MANUAL. Each section of the manual is published as a separate Technical Report but is designed for use as a unit of the manual. For best retrieval, this report should be filed according to section number within Chapter 7.

SMOOTH BROME (*Bromus Inermis*)

Section 7.1.1, US ARMY CORPS OF ENGINEERS WILDLIFE RESOURCES MANAGEMENT MANUAL

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Smooth brome is a widely adapted, long-lived perennial grass. Its smooth, broad leaves, good palatability, and high productivity make it a preferred species for pasture or hay and in rangeland seedings. Smooth brome forms a dense sod and is useful for both wildlife cover and soil conservation purposes.

DESCRIPTION

Smooth brome has erect to spreading culms that are usually 2 to 4 ft (6 to 12 dm) tall (Fig. 1). Each plant has numerous laterally spreading rhizomes that give rise to new plants. Leaf blades are smooth, flat, and lax; they are up to 0.5 in. (1.3 cm) wide and 15 in. (38 cm) long. An "M" near the middle of the blade and an irregularly rounded ligule at the base of the blade help identify this species. The leaf sheaths are unsplit, which is unusual among grasses. The flower heads are in contracted to open panicles, 4 to 8 in. (10 to 20 cm) long. Spikelets are cylindrical to somewhat flattened and contain 5 to 10 florets; lemmas are flattened, brown at maturity, and awnless or minutely awned from between split tips. The flowering branches usually flare

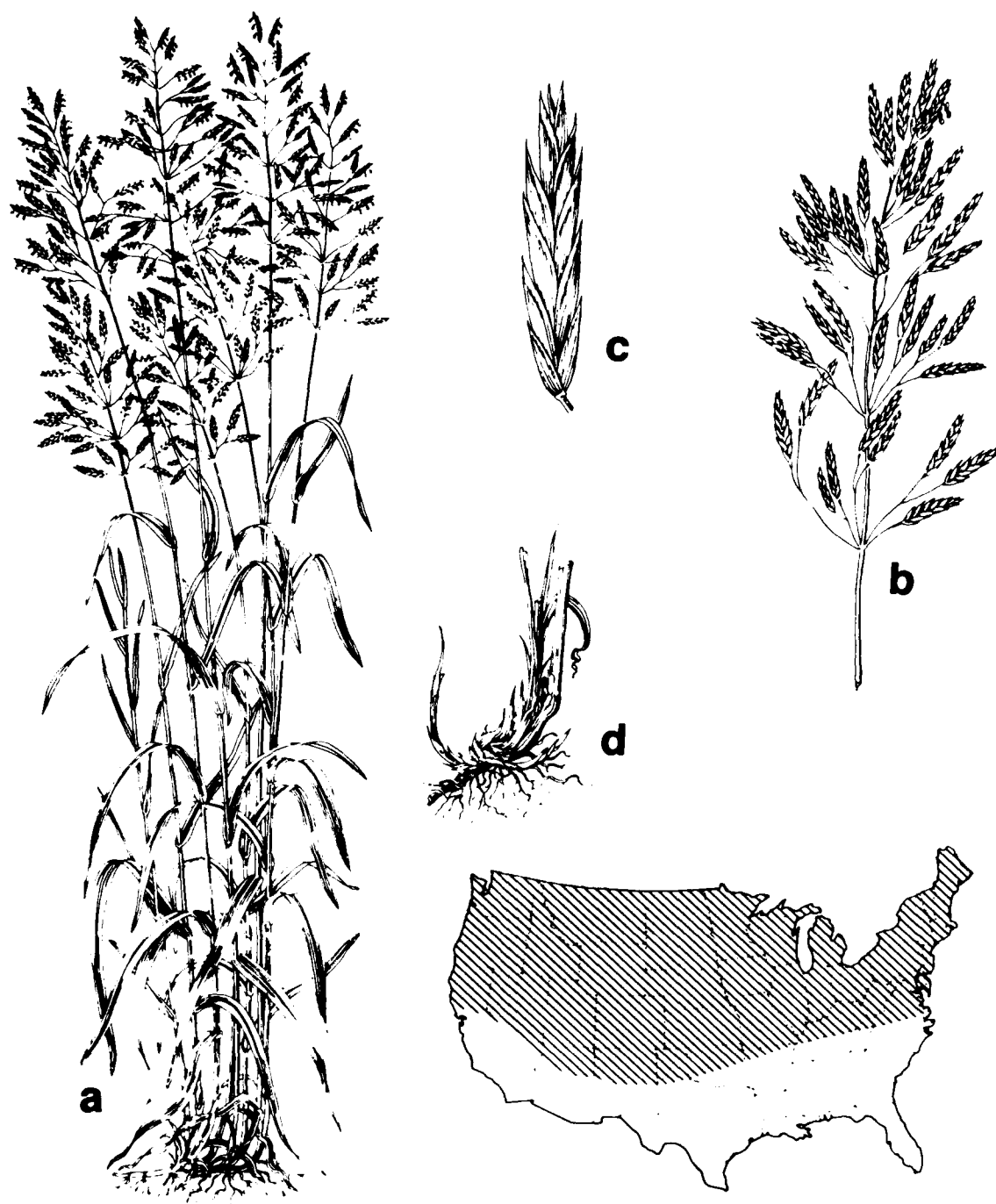


Figure 1. Distribution and distinguishing characteristics of smooth brome (*Bromus inermis*): (a) entire plant, (b) panicle, (c) spikelet, and (d) root system

outward and upward after flowering, although southern strains tend to droop or nod to one side (Vallentine 1967, Wasser 1982).

Plants grow vigorously from mid-spring until summer, with less vigorous growth in the fall. The growth rate slows after plants produce seedheads, but this is less pronounced at lower elevations where there is adequate soil moisture and fertility and at higher elevations where maturity is delayed until near fall (Vallentine 1967, Derscheid et al. 1979). The dense, fibrous roots of smooth brome commonly extend 3 ft (9 dm) or deeper into the soil. Smooth brome is both soil conserving and resistant to damage by hooves because of its coarse rhizomes and large volume of root material in the top 6 to 12 in. (15 to 30 cm) of the soil (Johnson and Nichols 1970, Newell 1973).

DISTRIBUTION

Smooth brome was introduced from central and northern Europe, Siberia, and China. The many ecotypes and varieties that exist are often grouped into northern and southern strains. The southern strains are better adapted to the Corn Belt, central Great Plains, and lower elevations of western mountains. The northern strains are better adapted to the northern Great Plains, higher western mountains, and parts of New England (Wright et al. 1967, Newell 1973). Smooth brome is used as a pasture grass in the northern two-thirds of the United States and has become naturalized in much of this area (Johnson and Nichols 1970). It is used widely for range reseeding in the West (Plummer et al. 1968).

HABITAT REQUIREMENTS

Soils

Smooth brome thrives in deep, fertile soils that are either silty or clayey (Thornburg 1982); it is less productive in clays and sandy soils and is not suited to sands. Smooth brome will grow in moderately acidic and moderately alkaline soils but is best suited to soils with a pH between 6.5 and 7.5. Plants are tolerant of moderately saline soil (3 to 6 μ hos), but they will not grow in strongly saline or sodic (alkali) soils (Bernstein 1964, Shaw and Cooper 1973, Newell 1978, Troeh et al. 1980). Smooth brome is very sensitive to soil fertility levels and may become sodbound 3 to 5 years after planting if there is a soil nitrogen deficiency.

Moisture

Mature plants can tolerate up to 4 weeks of flooding, and seedlings can withstand up to 8 weeks. The species is moderately drought tolerant and usually survives all but the most protracted droughts. Southern strains are generally more drought tolerant than are northern strains. Smooth brome generally grows in areas with 15 in. or more of annual precipitation, although it may grow well in lower rainfall zones where runoff water is available (Lang et al. 1975, Thornburg 1982). The species is most productive when irrigated or in areas with 18 to 20 in. of annual precipitation (Hafenrichter et al. 1968, Shaw and Cooper 1973, Newell 1978).

Shade

Smooth brome is moderately tolerant of shade; plants can withstand shade better than most grasses used to seed mountain shrub vegetation types (Plummer et al. 1968, Shaw and Cooper 1973).

WILDLIFE VALUE

Martin et al. (1951) reported that a wide variety of birds and mammals use the foliage and seeds of brome grasses (Table 1). Kufeld (1973) and Kufeld et al. (1973) found that smooth brome was an important component of the diets of mule deer (*Odocoileus hemionus*) and elk (*Cervus elaphus*) in the Rocky Mountain region. The species is a major part of seed mixtures used to restore big game spring-fall and winter ranges for deer and elk in Utah (Plummer et al. 1968).

Ring-necked pheasants (*Phasianus colchicus*) often use roadsides as nesting cover when they are sown to alfalfa (*Medicago sativa*) and smooth brome (Joselyn and Tate 1972). Hammerstrom et al. (1957) noted that nesting habitat was provided for greater prairie-chickens (*Tympanuchus cupido*) on the Buena Vista Marsh in Wisconsin in areas where the grass seed crops, including brome grasses, were not harvested until after the eggs hatched. Brome was also one of the species recommended for use in establishing new grass seed-producing areas outside of established pheasant range in the state.

Fields that are not well suited to crop rotations in the North Central and Pacific Northwest States sometimes remain in alfalfa and smooth brome mixtures for several years. These pastures can provide good small game cover,

Table 1. Wildlife species known to use *Bromus* spp. as food
(Martin et al. 1951)

<u>Animal Species</u>	<u>Plants</u>	<u>Seeds</u>
<u>Waterfowl</u>		
Canada goose (<i>Branta canadensis</i>)	X (young)	
<u>Upland game birds</u>		
Gray partridge (<i>Perdix perdix</i>)		X
Ring-necked pheasant (<i>Phasianus colchicus</i>)		X
Mountain quail (<i>Oreortyx pictus</i>)		X
<u>Songbirds</u>		
Snow bunting (<i>Plectrophenax nivalis</i>)		X
Lark sparrow (<i>Chonodestes grammacus</i>)		X
Song sparrow (<i>Melospiza melodia</i>)		X
Vesper sparrow (<i>Pooecetes gramineus</i>)		X
White-crowned sparrow (<i>Zonotrichia leucophrys</i>)		X
<u>Small mammals</u>		
Nuttall's cottontail (<i>Sylvilagus nuttalli</i>)	X	
Least chipmunk (<i>Eutamias minimus</i>)	X	
Townsend's chipmunk (<i>E. townsendii</i>)	X	
Western chipmunks (<i>Eutamias</i> spp.)	X	
Pocket gophers (<i>Thomomys</i> spp.)	X	
Townsend's ground squirrel (<i>Spermophilus townsendii</i>)	X	
Northern grasshopper mouse (<i>Onychomys leucogaster</i>)	X	
Pocket mice (<i>Perognathus</i> spp.)	X	
Black-tailed prairie dog (<i>Cynomys ludovicianus</i>)	X	
White-tailed prairie dog (<i>C. leucurus</i>)	X	
<u>Big game mammals</u>		
Pronghorn (<i>Antilocapra americana</i>)	X	
Mule deer (<i>Odocoileus hemionus</i>)	X	
White-tailed deer (<i>O. virginianus</i>)	X	
Elk (<i>Cervus elaphus</i>)	X	
Mountain goat (<i>Oreamnos americanus</i>)	X	
Moose (<i>Alces alces</i>)	X	
Mountain sheep (<i>Ovis canadensis</i>)	X	

depending on grazing and mowing activities. Areas left in smooth brome-alfalfa mixtures often include the ends or edges of fields and waterways (Allen 1956). When grown alone smooth brome results in low diversity of cover due to its ability to outcompete other species (Wasser 1982).

ESTABLISHMENT

Site Selection

Sites with sparse vegetation or dense stands of undersirable species are often suitable for establishing smooth brome. These include deer and elk concentration areas in tall mountain shrub, open conifer and aspen forest, sub-alpine herbland, and meadow cover types. Agricultural areas where smooth brome can be grown profitably as a seed crop using minimum tillage practices often provide good wildlife habitat. Other suitable sites for establishing smooth brome include areas that are waste, secondary, or tertiary in terms of their farming value but where a permanent cover is desirable, such as waterways, gullies, and field ends and edges.

Roadside plantings of smooth brome for pheasants are most beneficial in intensively cropped areas where less than 3% of the total area contains cover suitable for pheasant nesting. Roadside plantings should be made along secondary roads where traffic is light. The cooperation of farmers and road maintenance personnel is important to the success of these plantings because weed control and other maintenance activities need to be timed so that they do not interfere with nesting.

Site Preparation

Plot design. Planting sites can be circular plots up to 1200 ft in diameter, but elongated, irregularly shaped tracts, up to 1/4 mile wide and at least 1 mile long are more desirable. Equipment use and soil conservation efforts will be more efficient when the length of the plot parallels existing contours. Natural cover should be left along drainages and ridges, and islands of good cover and forage should be left within the treated areas (Plummer et al. 1968, Williamson and Currier 1971). Cover that provides concealment for big game should be available within 600 ft of the center of areas planted to smooth brome and other grass mixtures (Reynolds 1962, 1966).

Mechanical treatment. Low brush on rangelands can be thinned and the soil scarified by brushland plowing. Chaining is more effective in areas with

taller shrubs and woodland trees and on sites with gradients greater than 30%. Slopes of 50% or greater can be treated with pipe harrows. Meadows are most effectively prepared by using cut-away disks before working the area into a suitable seedbed. Mineral soil must be exposed for planting and reducing competition so that seedlings can become established. Soil scarification and seeding can be done in one operation with rotoseeders (Joselyn and Tate 1972). The natural settling of soils during winter usually covers seed broadcast in late fall on chained or harrowed rangelands (Plummer et al. 1968).

Roadsides should be prepared by disking and firming the seedbed prior to drilling. Farmlands are usually plowed in the fall or spring, followed by disking, harrowing, and rolling or packing to firm the seedbed where needed. Traditional farm equipment and methods are applicable only on reasonably level, rock-free sites. Local expertise may be helpful in determining the best ways to prepare clays and sticky shale soils and parent materials for successful smooth brome establishment.

Soil amendments. Fertilizers are seldom needed for seeded rangelands but may be required in humid regions and on disturbed lands that lack topsoil. Nitrogen fertilizers can be applied to the soil surface with a spreader or a fertilizer drill. Phosphates should be worked into the root zone before planting. Lime should be applied before planting on acidic soils, particularly when alfalfa is part of the seeding mixture.

Propagule Selection

Smooth brome is usually propagated by seed. Sod pieces can be used but are usually reserved for critically eroded areas because of high cost (Plummer et al. 1968). Southern strains of seed are preferred in mountain brush and juniper-pinyon range types in Utah. A mixture of equal parts of northern and southern strains of smooth brome is recommended for aspen and associated conifer types in subalpine herblands; northern strains are preferred in meadows.

Cultivars. Local and regional plant material specialists of the U.S. Department of Agriculture or State agricultural experiment stations can be contacted for information on the variety of smooth brome best adapted for a particular planting site and purpose. Selected northern and southern strains and their general characteristics are given below (Wasser 1982):

Northern strains (origin)

Parkland (Canada)
Superior (Canada)
Manchar (Washington)
Carlton (Canada)
Homesteader (South Dakota)
Martin (Minnesota)
Kuhl (Oregon)
Saratoga (New York)

Southern strains (origin)

Lincoln (Nebraska)
Achenbach (Kansas)
Fischer (Iowa)
Elsberry (Missouri)
Lancaster (Nebraska)
Lyons (Nebraska)
Southland (Oklahoma)

Characteristics of northern strains

Symmetrical open panicle
Weakly rhizomatous
Better seed producer
Slower sod binding
More recovery after cutting
Less drought resistance
Less seedling vigor
Later spring grower

Characteristics of southern strains

One-sided, drooping panicle
Strongly rhizomatous
Poorer seed producer
Rapid sod binding
Less recovery after cutting
More drought resistance
More seedling vigor
Earlier spring and later fall
grower

Seed selection. Fulbright et al. (1982) state that there are 124,000 to 200,000 smooth brome seeds per pound. Wasser (1982) recommended seed quality standards of 92% purity, 85% germination, 78% pure live seed, and 140,000 to 145,000 seeds per pound. Wasser (1982) reported that smooth brome has strong seedling vigor and that the usual 85% germination rate in 14 days can be improved by a short prechilling treatment (stratification). Fulbright et al. (1982) reported good seed viability for 2 to 5 years after harvest, and for as long as 14 years in some cases. They reported a germination rate of 81% to 95%.

Planting Methods

Time of seeding. Late fall, winter, or early spring planting of smooth brome is preferred in the western mountain regions. Early spring is the more common planting time in the northern Great Plains and North Central States. In the West, seedlings can be made from late summer to 6 weeks before frost at lower elevations where late summer-fall moisture is dependable (SCS 1965, Plummer et al. 1968, Wasser 1982).

Seeding. Seeds can be broadcast or drilled. Planting depth varies from 1/2 in. in coarse soils to 1 in. in finer textured soils (Wasser 1982). Smooth brome seeds are light and do not feed through drills uniformly.

Therefore, they need to be mixed with some inert material, such as cracked grain or rice hulls, or seeded with a special grass drill that has agitators in the seedbox. When smooth brome and alfalfa are sown together, the brome seed should be put in the large seedbox and the alfalfa seed in the small (legume) seedbox. To minimize competition, the 2 species should be sown in alternate 12- to 16-in. rows in drier areas and 6- to 8-in. rows in more humid zones.

When smooth brome is drilled alone, 15 to 20 seeds/ft² (5 to 7 lb/acre) is an adequate rate in drier zones; twice this rate is recommended for establishing hay fields and pastures in humid or irrigated areas. Rates 1.5 to 2.0 times greater should be used when smooth brome seed is broadcast. These rates can be doubled when the goal is to stabilize critical areas (Wasser 1982).

Mulch may be necessary for good establishment of smooth brome on steep slopes, critical areas, and cuts. Straw, hay, or bedding material, with manure for anchoring the mulch, are useful in these areas. Other methods of anchoring the mulch may be necessary if it is applied without the addition of manure.

Transplanting. Smooth brome sod can be cut with a sod cutter when the soil is moist. The sod is rolled with the roots turned inside, transported to the revegetation site, and planted. Thorough watering of the root-soil contact zone is necessary for good establishment. Sprigging and scattering sod pieces with a manure spreader, followed by rolling or disking with the disks set straight, can also be used to establish smooth brome.

Planting mixtures. When possible, smooth brome should be planted with alfalfa or another perennial legume to provide soil nitrogen. Simple mixtures of 1 or 2 grasses, with alfalfa comprising up to 50% of the seed mix, are commonly used for roadside and agricultural plantings. Alfalfa can be seeded at rates of 1 to 12 lb/acre, with smooth brome comprising 10% to 50% of the total seed mixture. Seed mixtures of 10 to 20 species are preferred for revegetation in Utah; smooth brome is generally seeded at rates of 1 to 8 lb/acre, and comprises 10% to 30% of the total seed mixture used (Plummer et al. 1968, Joselyn and Tate 1972, Newell 1978, Wasser 1982).

MAINTENANCE

Grazing and Mowing

Smooth brome should not be grazed during the establishment year; the crop, however, can be mowed after the first frost. Brome should not be mowed or grazed until it has reached the boot stage (stage at which the seeds are developed but not yet emerged from the sheath) or until the alfalfa has reached the 10% bloom stage, whichever comes later. Fall regrowth of brome can be grazed after it has reached 8 to 10 in. in height and crown tillers are ready to develop (SCS 1965). Rotation mowing and grazing schedules work well with brome, but usually no more than 2 crops per year can be harvested without decreasing productivity.

Alfalfa should be left uncut for 30 days prior to the first fall frost each year (Ditterline et al. 1976). Therefore, in most cases the second mowing or grazing of a brome-alfalfa mixture should be delayed until after frost (Wright et al. 1967, Derscheid et al. 1979). A stubble of at least 4 to 6 in. should be maintained at all times with all defoliating schedules. Seedings of alfalfa-smooth brome established as nesting cover along roadsides, field edges, pastures, and waterways should not be mowed or grazed until after broods have left their nests (Joselyn and Tate 1972).

Smooth brome plants are tolerant of infrequent cutting after the seeds mature, but are somewhat sensitive to cutting before seed maturity (Wright et al. 1967). They withstand partial defoliation, such as that caused by grazing, somewhat better than cutting.

Fertilization

Regular annual nitrogen fertilization, as well as treating other soil nutrient deficiencies, should be practiced when alfalfa is significantly less than 50% of the seeding mixture. Additional nutrients may be needed for smooth brome seedings in humid zones, excessively drained soils, and on certain other soils and parent materials (Newell 1978). A fertilization program is necessary to maintain sustained high levels of production, and conservative fertilization may be needed to maintain moderate cover.

Weed Control

Nongrassy weeds in a smooth brome monoculture can be sprayed with herbicides (e.g., a low-volatile ester or other formulation of 2,4-D). Herbicide and weed control handbooks are available that include information on the

correct rates and carriers. Seedlings should not be sprayed until they have 4 leaves or are at least 6 in. tall. Weeds can be mowed before they flower with a cutter bar set well above the smooth brome and alfalfa seedlings.

CAUTIONS AND LIMITATIONS

A stubble of 4 to 6 in. should be maintained at all times with any defoliating schedule. For effective use as nesting cover, alfalfa-smooth brome plantings should not be mowed or grazed until after broods have left their nests (Joselyn and Tate 1972). Smooth brome is becoming less popular for growing in alfalfa mixtures because it is adversely affected by the multiple-cutting schedule commonly used for alfalfa (Ditterline et al. 1976, Newell 1978).

Smooth brome results in low diversity of cover when grown alone. Pure stands also soon become rootbound. Grasshoppers and rodents may damage stands and/or forage. Considerable leaf and stem rust, leaf spot, stripe, and occasionally heat smut can affect forage and seed quality, especially in wet years. Fungicidal seed treatment aids in control of seed-borne seedling diseases (Wasser 1982).

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